



**MT 26**  
**International Conference**  
**on Magnet Technology**  
 Vancouver, Canada | 2019

Contribution ID: 1218

Type: **Poster Presentation**

## **Tue-Af-Po2.19-11 [50]: Self-field AC loss measurement of a four-tape HTS stack using Fiber Bragg Grating sensors**

*Tuesday 24 September 2019 14:00 (2 hours)*

Understanding AC loss in High Temperature Superconductor (HTS) magnets is critical to application. The common methods for AC loss measurement are electrical and calorimetric measurements. It is generally accepted that calorimetric techniques are superior to electrical methods when there is a phase difference between the transport current and external magnetic field. A common challenge in calorimetric measurements is the interaction of an electric thermal sensor with the magnetic field; it has been proposed that an optical fiber sensor that is immune to EMI can overcome this challenge. Other researchers have demonstrated the feasibility of the calorimetric method measurement based on Fiber Bragg Grating (FBG) sensors on single HTS wire.

In this work, we demonstrate the calorimetric method measurement for self-field AC losses on a four-tape HTS stack using FBG sensors. Several types of cryogenic FBG temperature sensors were selected for the thermal measurement to study the available optimized loss sensitivity. These measurements were carried out at 77 K through conduction cooling in a cryostat. A heater was used to calibrate AC loss values in the measurement. The effect of bonding on the AC loss sensitivity was analyzed by comparing the fully bonded and single-end-bonded sensors. The magnetic strain effect on the measurement was also evaluated using fully bonded FBG sensors through comparison of the experimental and theoretical results. The measured loss results were verified through comparison with the FEM simulation results using H-formulation and electrical measurements of AC-loss. The results in our paper shows that the calorimetric method based on FBG sensor can be used for the AC loss measurement of the four-tape HTS stack, which provides the possibility of ac loss measurement on HTS coils.

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**Session Classification:** Tue-Af-Po2.19 - Losses in Conductors and Coils II